



Addressing Climate Change

Issues and solutions from around the world





The designation of geographical entities in this book, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of IUCN concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The views expressed in this publication do not necessarily reflect those of IUCN.

Published by: IUCN, Gland, Switzerland

Copyright: © 2010 International Union for Conservation of Nature and Natural Resources

Reproduction of this publication for educational or other non-commercial purposes is authorized without prior written permission from the copyright holder provided the source is fully acknowledged.

Reproduction of this publication for resale or other commercial purposes is prohibited without prior written permission of the copyright holder.

Citation: Elizabeth Willetts, Lorenzo Guadagno, Ninni Ikkala, Editors. Gland, Switzerland: IUCN. 40pp.

ISBN: 978-2-8317-1278-9

Front cover photo: Natalie Stalenberg

Back cover photo: Senja Väättäinen

Layout by: Daniel Shaw, IUCN

Produced by: IUCN

Printed by: Electronic version only.

Available from: IUCN (International Union
for Conservation of Nature)
Publications Services
Rue Mauverney 28
1196 Gland
Switzerland
Tel +41 22 999 0000
Fax +41 22 999 0020
books@iucn.org
www.iucn.org/publications

A catalogue of IUCN publications is also available.

Addressing Climate Change

Table of contents

IUCN and Climate Change	4
1. Climate change around the world	5
Climate change in Africa	6
Climate change in Asia	9
Climate change in the Mediterranean	13
Climate change in Oceania	17
Climate change in South America	20
2. Selected climate change issues	23
Gender and climate change	24
Climate change and environmental law	26
Oceans, coasts and climate change	27
Social policy and climate change	31
Species and climate change	33
Water and Climate Change	36
Climate change and IUCN commissions	39

IUCN and Climate Change

The evidence of climate change is compelling: sea levels are rising, glaciers are retreating, precipitation patterns are changing, and the world is getting warmer. According to the Intergovernmental Panel on Climate Change (IPCC), the current rate of greenhouse gas emissions is likely to cause average temperatures to rise by 0.2°C per decade, reaching by 2050 the threshold of 2°C above pre-industrial levels. Recent evidence suggests even more rapid change, which will greatly, and in some cases irreversibly, affect not just people, but also species and ecosystems.

Climate change is one of four priority Thematic Programme Areas (TPA) in the IUCN Programme for 2009-2012. IUCN's climate change work focuses on bringing biodiversity considerations into climate change policy and practice. Nature can offer immediate, sustainable solutions to mitigation through capturing carbon in forests and other ecosystems. Ecosystems also play a key role in increasing the resilience and reducing the vulnerability of livelihoods in the face of climate change, for example through integrated water resource management, sustainable agriculture or coastal zone management. We also work to ensure that equity considerations, in particular the role of women and indigenous peoples, are integrated into climate change policy and practice.

This publication synthesizes information on IUCN's work in this domain, particularly highlighting programmatic work in projects at local and national level, implemented by IUCN's Global thematic and Regional Programmes and Commissions. It serves as an introductory "where we are at" on climate change response in some areas of our work.

About IUCN

IUCN, International Union for Conservation of Nature, helps the world find pragmatic solutions to our most pressing environment and development challenges.

IUCN works on biodiversity, climate change, energy, human livelihoods and greening the world economy by supporting scientific research, managing field projects all over the world, and bringing governments, NGOs, the UN and companies together to develop policy, laws and best practice.

IUCN is the world's oldest and largest global environmental organization, with more than 1,000 government and NGO members and almost 11,000 volunteer experts in some 160 countries. IUCN's work is supported by over 1,000 staff in 60 offices and hundreds of partners in public, NGO and private sectors around the world.

www.iucn.org

For more information, please contact :

Ninni Ikkala
Climate Change Coordinator
IUCN World Headquarters
Rue Mauverney 28
1196 Gland
Switzerland
Tel: +41 22 999 0106
Fax: +41 22 364 9622
ninni.ikkala@iucn.org
www.iucn.org/climate

1. Climate change around the world





Picture: Restored forest in Inner Niger Delta, Mali

Climate change in Africa

West and Central Africa are among the poorest regions in the world. Their contribution to greenhouse gases emissions are also the lowest ones, except those coming from deforestation, especially in the Congo Basin which is the second largest tropical forest block, (although still with a globally low deforestation rate). Countries of Central and West Africa are particularly vulnerable to climate change, in particular in the arid to semiarid zone which represent a large part of the region. They do not have enough means and capacities to face change and possible crisis.

Nevertheless, West Africa has already experienced a challenging period of severe climate change when rainfall regularly decreased by 30 to 40 % all over the region, starting from the major drought of the early 1970s until the early 2000s. This may explain why in West Africa, most of the stakeholders are focused on adaptation strategies. Indeed,

the common understanding is that emissions are very low, while temperatures may increase and rainfall distribution changes significantly, impacting severely upon the conditions of agriculture, livestock, water resources distribution, etc. Coastal zones are largely threatened due to coastal erosion and sea level rise.

During the long period of depleting rainfall at the end of the twentieth century, communities tested and implemented various strategies to adapt with some success. Indeed, despite the very difficult conditions, the cereal production per capita in the Sahelian dry part of the region never dropped and even increased slowly over the period. As many countries are in the process of designing their national adaptation strategies, local strategies to cope with climate change should be considered as tested, efficient strategies upon which the countries could build their national approaches to adaptation.

The IUCN response

IUCN has worked on collecting information on traditional adaptation practices and carried out

training on the use of participatory adaptation tools such as CRiSTAL. We have supported coastal zone management plans in the face of climate change across coastal West Africa. IUCN has convened policy dialogues and helped prepare national delegations to the UNFCCC. We have also initiated *REDD Readiness* projects.

Case Study 1: Adaptation in Burkina Faso

In Burkina Faso, IUCN has led with its members and partners a country wide process of collecting information and lessons on endogenous adaptation strategies to climate change. These strategies include various combinations of soil and water conservation techniques (*zaï, stone barriers, woody barriers, perennial grass, rain water collection and storage, half moons, compost, mulching, etc.*), production systems (*agro forestry, crop-livestock integration, small irrigation*) and production techniques (*improved crop seeds, intercropping, mixed cropping, animal fattening, type of tillage, etc.*). Forms have been filled for each strategy, discussed and validated through a national forum gathering a hundred local stakeholders together with decision makers.

This collection of forms and the utilization guide will be published soon to inspire national adaptation strategies and engage all types of stakeholders including the women and the poorest ones. The Burkina office has set a pool of trainers on the CRiSTAL toolkit from different institutions to facilitate vulnerability analyses at community level. The appropriate adaptation strategies identified through these analyses will be supported through a small grants program. In particular, communities of the Central West region have asked IUCN to support the use and economic value of non-timber forest products to improve their livelihoods and capacity to face natural hazards and climate variability.

Case study 2: Regional adaptation plan

IUCN, among other stakeholders, has contributed to the elaboration of a regional climate change adaptation plan, through which ECOWAS, the West Africa regional economic community is leading a regional approach to climate change. The plan builds on strengthening the regional institutions to enable them to support the states and the regional

economy on the one hand, and harmonizing and coordinating approaches of stakeholders and mainstreaming climate change into priority regional and multi-country investments, programmes and projects on the other hand.

Parliamentarians are amongst major stakeholders in the governance processes at country level, but also at regional level, in mainstreaming environmental concerns such as climate change into national laws and policies. Since 2007 IUCN has supported parliamentarians' groups for environment in various countries, including Senegal, Cape Verde and Guinea Bissau, in recruiting assistants to help them collect information, facilitate contacts and make statements to their Parliaments. In Central Africa (REPAR) and in West Africa coastal zone (REPES) two regional networks of Parliamentarians for Environment have been created with IUCN support. In 2009, parliamentarians from seven countries of West Africa coastal zone met in Cape Verde to be trained on climate change issues and the scope and stakes of the international agenda. IUCN staff also supported the national delegations of Burkina Faso and Senegal to the Copenhagen climate change convention.

Case study 3: Mangroves and coastal management

While mangroves have been recognized as one of the best protection against coastal erosion, it is also established that they may have a strong role in carbon sequestration. Many stakeholders are implementing activities at local and national levels to protect, preserve and manage mangrove ecosystems. IUCN and Wetlands International have initiated a regional coalition of actors to develop a vision on the mangroves of seven countries of West Africa, from Mauritania to Sierra Leone. Together they have drafted a Regional Charter on mangrove management, which is about to be validated at the country levels.

In recognition of this important result, UEMOA, the West African Economic and Monetary Union, has committed IUCN to support all the 11 coastal countries of West Africa, from Mauritania to Benin, to build a regional coastal management plan and a regional mechanism for long term monitoring of sea level rise and coastal erosion. Based on national data, institutions and regional dialogue, the plan will include a regional map on coastal sensibility and related risks, a characterization of the

challenges that the countries will have to face, and recommendations to be considered in the frame of the adaptation and mitigation strategies and the territorial management policy for coastal zones, in order to reduce the costs

and the impacts of climate change. It will also give a comprehensive analysis of the threats to the coastal area, should they come from the sea or from the inland, such as river basin management.

Climate change in Asia

During the last decades, Asia has been experiencing unprecedented rates of economic and demographic growth. Its huge population has been steadily increasing, largely concentrated in urban areas, making its cities among the most densely populated in the world. Three of the world's top five emitters of greenhouse gases (China, India, and Japan) are Asiatic countries. Stresses on the local environment are increasingly severe.

The continent presents an extreme diversity of climatic zones, ranging from tropical rain forests to deserts. Most Asian countries are highly vulnerable to natural hazards (e.g. floods, droughts, sea-level rise, cyclones and diseases) and ecosystem degradation (e.g. coral bleaching, deforestation and forest degradation). Global climate change on the one hand is making communities more exposed to extreme events and environmental change, and on the other is further reducing their resilience and coping capacity, drastically exacerbating existing vulnerabilities.

Water is a critical factor for the future of people and economies in the continent. The vast Tibetan plateau is the water tower of Asia and source of nine of the great river systems of China, South-East and South Asia. These rivers are fed by glaciers that are experiencing a retreat process, due to temperature increases, that tend to be above average in mountainous areas. Glacier melt will affect water supply, food and energy production for billions of people. Over-extraction of ground water, increase in salinity, and desertification will further threaten water availability, undermining food security in largely agricultural economies.

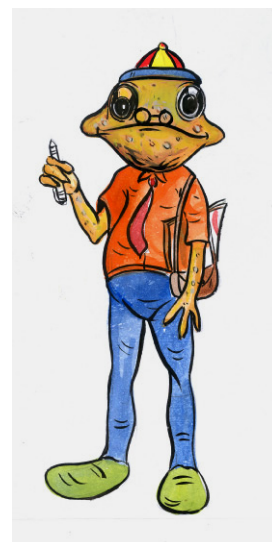
Climate change effects are already being experienced. Despite factual evidence and the magnitude of possible consequences, climate observation in the region is poor, with the IPCC calling the greater Himalaya a data "white spot". The little information that does exist is rarely shared, limiting each country's ability to model, predict, and prepare for changes. Forums such as the *Mekong River Commission's Climate Change Initiative*, UNEP's *Sustainable Development Strategies*, and *Regional Climate Adaptation Platform for Asia*, as well as the capacity building programme, *Cities at Risk*:

Developing Adaptive Capacity for Climate Change in Asia's Coastal Megacities, are now aiming to reverse this situation.

The IUCN response

IUCN has offices in Bangladesh, Cambodia, China, India, Indonesia, Lao PDR, Nepal, Pakistan, Sri Lanka, Thailand, and Viet Nam, and is otherwise working in Korea and Mongolia. It has collected considerable experience on climate change adaptation initiatives in Bangladesh; increasing work on technical and strategic advice in Pakistan; and mainstreaming adaptation into the development framework in Viet Nam and in China. It is also working with the Mekong River Commission on their Climate Change Initiative in the Lower Mekong. IUCN Pakistan has facilitated a conference focusing on Climate Change: Challenges and Opportunities for South Asia.

In order to build resistance and resilience to the impacts of climate change, IUCN Asia is adopting a new approach, by moving from reactive response to proactive activities that address long-term sustainable management needs and develop community coping capacity, including the development of awareness and strategies for improved food and livelihood security, disaster preparedness, and climate change adaptation.



Case Study 1: Rana Bhai the frog — climate change adaptation ambassador in Bangladesh

Inspired by the success of the 'Entertainment Education' approach of UNICEF *Meena Communications Initiative*, IUCN Bangladesh, in partnership with the Netherlands Government's *Char Development and Settlement Project*, has developed several educational materials aimed at raising awareness of climate change and appropriate adaptation measures among school children.

IUCN Bangladesh has created a character called 'Rana Bhai', a clever frog who can convey positive climate change and adaptation messages to primary, secondary, and *madrasha* students in Noakhali District, southern Bangladesh. Rana Bhai acts as a climate change ambassador and appears on stickers, posters and books advocating climate change adaptation messages, encouraging school children to engage with adaptation measures in their community and discussing them with their families and friends, acting as information disseminators.



Focused discussions with school children in the district revealed that many had basic levels of awareness of climate change, but were confused about appropriate adaptation actions and overwhelmed by the hopelessness of the situation. Rana Bhai has proved effective in overcoming both the obstacles, and reactions from the target audience have been highly positive. IUCN Bangladesh is considering using the character in other climate change adaptation and awareness raising projects, and is planning to reach out to a wider audience through a short play to be performed by schoolchildren and filmed as part of a documentary.

Case Study 2: Mangroves for the Future (MFF) initiative

Coastal ecosystems, especially mangrove forests and coral reefs, act as buffers against extreme weather events, reducing vulnerability of coastal communities and their investments. Sea grasses are indispensable nursery grounds

for many fish species and feeding habitats for turtles and dugongs. In several Asian countries mangrove loss has exceeded 60% in recent decades, mostly due to the clearing of forests for shrimp farming and other forms of coastal development. Even if global stresses, such as climate change, will increasingly affect these fragile ecosystems, the minimization of their degradation due to local human activities will still be crucial to their survival.

MFF's objective is to strengthen the environmental sustainability of coastal development and promote sound investments in coastal ecosystem management, as a means of enhancing resilience and supporting local livelihoods.

It is an IUCN-led partnership-based initiative that includes all coastal ecosystems, seeking to guarantee a more prosperous future for all coastal populations in Indian Ocean countries.

It conducts activities that mobilize local communities and governments to undertake joint actions to ensure food security, build knowledge to better understand the links between livelihoods and climate systems, and increase adaptive capacity to meet the long-term development needs of coastal communities, while securing their livelihoods against climate change impacts and helping them prepare for potential climate-related disasters.



Considering climate change adaptation and enhancing adaptive capacity of coastal communities is crucial to ensure long-term sustainability of projects. MFF has integrated climate change considerations as a cross-cutting theme in its activities, based on existing climate proofing tools, and conducts regional training courses on the use of these tools and methods at the field/project level. The aim is to follow up with national training courses to build in-country capacities in the region. MFF aims to add value by linking up with training institutions and universities, to help gather:

- coastal and marine conservation policy-makers who are trying to decide how to proceed in addressing adaptation challenges without creating new laws or programmes,
- planners and/or project managers who want some practical approaches to act immediately, as well as
- communications and outreach professional seeking to make the connection between information, needs, and action.

MFF also organizes study-tours to promote cross-country exchanges of lessons learned in the region.

MFF seeks more effective and inclusive institutions, policies and mechanisms for cooperation at national and regional levels by prioritizing coastal climate change considerations across national development agendas, policies and budgets.

For more information see:
www.mangrovesforthefuture.org .

Case Study 3: Promotion of adaptation to climate change and climate variability in Bangladesh



The Noakhali district in South Bangladesh, an extremely poor and densely populated area, is severely exposed to cyclones and storm surges. Vulnerable local communities generally can't rely on sound climatic and meteorological forecasts, and lack the resources to cope with hazardous events. They frequently experience climate- and weather-related disasters.

In collaboration with the Netherlands Climate Assistance Programme (NCAP), IUCN has established the *Promotion of Adaptation to*



Climate Change and Climate Variability in Bangladesh project, to assess disaster risk, introduce pilot adaptive measures amongst communities, enhance the target audience awareness, and influence national policy makers. This approach has been used in awareness raising and influencing policy amongst stakeholders from the community level up to the political institutions.

The risk assessment has highlighted that the climate in Bangladesh is becoming more unpredictable every year. Precipitations are



becoming more erratic, dry spells longer, frequency and intensity of cyclones is increasing, causing an increase in floods and coastal inundations, saline water intrusion, soil salinization and loss of lives and livelihoods. These impacts have been identified and quantified for the communities in Noakhali. Table 1 lists some of the main impacts and relative adaptation options established through the risk assessment.

Table 1 - Impacts and adaptation options

Impacts	Adaptation options
Shift in fishing grounds	Promote sustainable fisheries and aquaculture
Changes and disruptions in fish migratory routes	Promotion of salt tolerant species
Decline in fish production and species abundance	Rehabilitation of degraded habitat and maintenance of fish migratory routes
Deaths and injuries from increasing number of shipwrecks caused by bad weather conditions	Improved boat quality and safety
Loss of housing due to structural fragility	Improved house structure quality using local material for affordability and integrity
Frequent water logging in crop fields	Floating bed agriculture, adaptive cropping, improved weather forecasting
Soil salinity	Capacity building in saline soil management



Picture: The building of more dams in the region results in an unsustainable over-exploitation of natural resources.

Climate change in the Mediterranean

In recent decades, the Mediterranean region has been experiencing a clear shift towards a warmer and dryer climate. Evidence suggests that:

- average annual temperatures have risen by 0.75°C during the 20th century;
- summer warming trends in the western part of the basin are more pronounced, with increases up to 3°C over the last 50 years;
- since 1970, winter precipitation have decreased in average by 20% in the basin;
- in coastal areas of Italy and Spain, the total number of wet days is decreasing and rainfall events are becoming scarcer and more intense;
- maximum temperatures have increased at larger rates than minimum temperatures.

Extreme weather events and summer water scarcity are among the main threats for wildlife and people in the Mediterranean region, which holds 3% of the world's freshwater resources

and 50% of the world's water-poor population. Droughts, common phenomena in the area, have increased in frequency and intensity in recent decades and will become even worse with rising temperatures and decreasing precipitation. Temperature records confirm the same trend for summer heat waves. Essential shifts in policy are required to help preparedness for drought events and prevent situations of chronic water scarcity. Current management responses call for more dams, more desalinisation plants, and more boreholes in order to guarantee water supply for an increasing demand, which result in an unsustainable over-exploitation of natural resources.

The complex interrelation between human impacts on natural ecosystems (bad management practices, intensification of natural resources exploitation, and rapid unsustainable land-use changes) and the predicted increase of heat waves are responsible for the alarming increase in frequency and intensity of harmful fires, with catastrophic effects on ecosystems degradation and biodiversity loss, people's livelihoods and human lives, and huge economic costs.

The ability that Mediterranean species and ecosystems have demonstrated to survive

under adverse and unpredictable conditions is linked to the evolution of cultural landscapes. Mediterranean mosaic landscapes tend to be relatively stable socio-ecosystems with high biodiversity levels, strong regional identities and culturally rich societies. This variety can reduce the likelihood of abrupt changes leading to irreversible ecological and socio-economic losses. Nevertheless, there is plenty of evidence of the local or regional disappearance of species or ecosystems in prehistoric times, caused by the synergetic combination of climate change (i.e. increase in temperatures) associated with too intense and/or rapid anthropogenic changes in land cover and management practices (i.e. extensive and severe fire activity for land clearance).

The IUCN response

The IUCN Centre for Mediterranean Cooperation has its office in Málaga (Spain), and is supporting regional members and partners on climate change adaptation issues. On terrestrial and freshwater adaptation issues, IUCN, in collaboration with FAO and WWF, has supported regional case studies and

discussions with scientists, nature resource managers, decision makers, NGOs, governmental aid agencies and UN regional offices, resulting in a joint position “Athens Statement” and a number of recommendations for climate change adaptation to build resilience of Mediterranean socio-ecosystems which were published and disseminated in several international events. The publication is available at:

http://cmsdata.iucn.org/downloads/adapting_to_global_change.pdf)

IUCN will support similar participatory processes to define common positions on climate change impacts, adaptation needs and options for drylands, and marine/coastal socio-ecosystems. IUCN support for mainstreaming adaptation into the Forest Law in Lebanon has been instrumental in the official approval of a new national strategy on forest fires, with a multisectoral and integrated approach to building ecological and social resilience and to reducing the risk of harmful fires, whilst allowing for fire regimes that are socially, economically, and ecologically sustainable.

In order to build ecological, social and cultural resilience to global change, i.e. the combined

Picture: Soil carbon pools play a significant role in sequestering atmospheric carbon, while at the same time improving site productivity (e.g. water retention and soil productivity).



effect of climate change and socio-economic impacts, IUCN is supporting a regional initiative, “*Mediterranean Mosaics*” aiming at the identification and implementation of adaptation measures influencing land management, markets, and policy frameworks in Mediterranean rural landscapes with outstanding ecological diversity and cultural values. This initiative brings together a number of projects in northern and southern Mediterranean countries and incorporates a trans-national component, mainly on capacity building and policy issues, as well as for exchanging/sharing know-how and joint actions.

Case study 1: Building fire-smart landscapes: a joint venture

Large scale fires are increasing as a consequence of climate change. National strategies allocating resources to fire fighting (i.e. buying of hydroplanes and helicopters) have proved inefficient when faced with the growing trend of devastating events. Integrated fire risk reduction strategies are needed which take into account the predicted increase of heat waves and dry spells as well as anthropic impacts on natural ecosystems, in order to increase ecological and social resilience and adaptive capacity. IUCN, WWF, FAO, and several partners in the region, agreed in April 2008 on the *Athens Statement*, a blueprint to introduce climate change adaptation considerations in forest conservation and management practices, with a special focus on increasing resilience against major disturbances.

In order to respond to the catastrophic effects of the forest fires of recent years, the Prime Minister of Lebanon launched in 2007 a participatory process for the revision of the National Forest Fire Strategy, in coordination with the Ministry of Environment and the Association for Forest Development and Conservation, involving all concerned governmental agencies (Ministries of Agriculture, Interior and Defence), representatives of civil society, IUCN Centre for Mediterranean Cooperation and Regional Office for Western Asia, as well as various cooperation agencies.

The new strategy aims at reducing the risk of intense and frequent forest fires, whilst allowing for fire regimes that are socially, economically, and ecologically sustainable. IUCN is supporting pilot actions to start implementing the new national strategy, mainly looking at

building ecological and social resilience against climate change impacts in high fire risk landscapes, by:

- developing a participatory planning process to design fire-resilient landscape patterns (type of uses and territorial distribution), and prevent land use changes which may alter their traditional mosaic structure and increase fire risk (i.e. the current trend of intensification of pine plantations);
- identifying fuel reduction opportunities through traditional (i.e. livestock grazing in high fire risk areas) and innovative land uses (i.e. bio-energy production from agriculture, forest waste products and dry biomass from shrub-land);
- developing and exploring opportunities such as innovative management systems and economic incentives, to support fire resilient land uses and landscape patterns;
- restoring healthy forest conditions, diversifying forest land with a higher number of native re-sprouting species which regenerate better after fire, and fruit trees/shrubs which attract seed-dispersal fauna. Restoring riparian forest corridors not only supports species migration needs in the face of climate change to climate change, but also reduces the capacity of fire to spread over the landscape;
- preventive silviculture and fuel management aiming at reducing the highly flammable biomass and the landscape susceptibility to fires, including grubbing and pruning, tree thinning, brushwood crushing, prescribed burning, controlled grazing and species selection.

Case study 2: Climate change adaptation in nature conservation: research on Mediterranean forest ecosystems

Mountain areas around the Mediterranean basin host an outstanding number of plant endemics and are a refuge for relict conifer tree species and other genetically valuable, isolated populations. Climate change and land use modifications are now having increasing impacts on habitats and species.

Dieback processes in the relic Pinsapo fir populations in southern Spain coincided with the forest canopy closure that followed the adoption of protection measures in the 1960s. Both climatic and intra-specific competition factors account for the observed increase in fir mortality. The reconstruction of changes in the water-use efficiency of trees during recent decades, and the implementation of experimental management practices by researchers from the University of Jaen (Spain), suggest that adaptation options for the Spanish Pinsapo fir population include:

a) the enhancement of the forest structural diversity at the stand level, through the implementation of a minor perturbation regime, such as low-intensity thinning practices, to improve water balance and reduce intra-specific competition;

b) the opening of forest gaps in previously too dense and homogeneous areas affected by pathogens, accelerating the subsequent natural regeneration (also from other tree species, such as *Quercus faginea*, *Q. rotundifolia*, and *Pinus*

halepensis) and promoting processes that increase heterogeneity and resilience at the landscape level.

The reduction of the higher respiration rates in Mediterranean forests, induced by global warming, appears to be crucial to reducing frequency and intensity of drought periods. Results from the SilviStrat EU project empirically proved that the reduction of density in re-sprouting evergreen oak coppice forests is a useful management technique to overcome the climate change induced forest dieback.

Picture: More frequent and intense droughts together with bad forestry practices cause intense forest dieback events: Dieback of cedar trees in the Middle Atlas Mountains (Morocco).





Picture: Sunset Suva soccer game, Photo Natalie Stalenberg

Climate change in Oceania

Oceania includes the Pacific Islands, Australia, and New Zealand, all connected by the Pacific Ocean, the world's vastest body of water, the veritable engine room to the Earth's climate. The coastal and marine ecosystems are essential for the region's provision of ecological goods and services supporting biodiversity and people's livelihoods, including food, timber, freshwater, medicines, shoreline protection, and nurseries for marine organisms.

Climate change is now putting at risk the very survival of nations, traditions, beliefs, and ecosystems throughout the area. The IPCC's Fourth Assessment Report indicates that even an immediate stabilization of greenhouse gas

concentrations would not prevent Oceania from suffering an extensive range of negative effects.

Biodiversity: Within the next 10 years we will witness significant species loss in Australia and New Zealand, especially in the Great Barrier Reef and other coral reef systems. On Pacific Islands, non-endemic species are expected to benefit from warmer climate, and changes in ocean temperature and pH levels will alter local ecosystems and force many marine species to leave in search for a new habitat.

Marine and coastal habitats: Mangroves, seagrass beds, and coral reefs will seriously be impacted, with sea levels predicted to rise by between 8 and 25 cm, and ocean temperatures by up to 2.5°C by 2050. Coral reefs usually tolerate temperatures between 20 and 30°C. In the Pacific, most of them are located in waters with temperatures ranging from 26 to 29°C. A slight increase will push temperatures above 30°C in some areas. Reef-building corals will be further threatened by ocean acidification,

caused by the increase in carbon dioxide concentration in the water.

People: Sea level rise will force tens of thousands of people to migrate from small Pacific Islands and other coastal regions. Entire nations, such as Kiribati and Tuvalu, lying less than two meters above sea level, could be lost forever. Such a movement of people is likely to cause conflicts over land and limited natural resources as well as cultural loss. A rise in sea levels, combined with more frequent and more intense cyclone events, will also increase the vulnerability of coastal settlements, structures, and activities to storm surges and strong winds, significantly impacting upon people's basic livelihoods.

Water security: Climate change will strongly affect precipitation patterns. It is predicted to lead to water security problems across the region by 2050, due to lower rainfall levels, higher temperatures, increasing evaporation rates, and salt intrusion in shallow coastal

groundwater supplies. In many Pacific islands, increased incidence of droughts, combined with increased sea level rise, could lead to the lack of access to any water source. In other areas, more intense precipitations could translate into increases in flooding, and loss of access to water due to damage to infrastructure or contamination.

Agriculture: Climate change is expected to have mixed effects on agriculture. Some parts of Australia and New Zealand may initially benefit from climate variations. Average production from agriculture and forestry in the region is expected to decline significantly by 2030 due to increases in droughts and fires. In the Pacific Islands, coastal agriculture will be affected by increased soil salinization due to sea level rise. In other areas, change in precipitation patterns and increasing incidence of extreme weather-related events could mean extensive loss of livelihoods for long periods of time, and could eventually cause famines.

Picture: Building an energy efficient home, Palau, Photo: Clarinda Ziegler



Economy: Natural disasters, such as cyclones, storms and floods, will increasingly undermine economic development in the region. Over the last six decades, an average of 2-7% of the total gross domestic products (GDPs) of all countries in the region, or about US\$ 2.8 billion in total, has been lost to extreme natural events. Melanesian countries experienced the largest relative impacts. These costs will be exacerbated by declining revenues from agricultural production and tourism, and will worsen the economic conditions of the local population, particularly of its poorest part, which has fewer financial assets to quickly recover from similar events.

The IUCN response

Studies on climate change in the Pacific suggest a multi-pronged approach to the management of climate related disasters is required. Attention needs to be given to reducing the vulnerability of particularly poor households living in hazardous areas, by improving their economic and social well-being, and by enhancing the management of ecosystems such as coral reefs, mangroves, and forests. Vulnerability reduction and enhancement of the people's coping capacity should be fundamental concerns in the planning and implementation not only of disaster risk reduction measures, but, more in general, of any development activity.

Case study 1 - Energy

Managing the Ecosystem and Livelihood Implications of Energy Policies in the Pacific Island States is an IUCN Programme working towards assisting the countries in the region in converting to sustainable renewable energy and energy efficiency systems. It is currently working with six Small Island Developing States (SIDS), supporting the development and implementation of sustainable energy policies, the management of several pilot projects on ecosystem conservation and livelihood enhancement, and the creation of a Pacific SIDS network to share lessons learned, skills, and technology.

In Palau the project targets energy efficiency in the homes and is being implemented by the National Development Bank of Palau (NDBP). It is expected to lower electricity consumption by an estimated 15% in newly-built homes. It will also create a local market for energy efficient products and services.

Case study 2 - Governance

The IUCN Oceania Virtual Pacific Centre for Environmental Governance comprises three sub-programs, environmental policy, environmental law, and environmental economics. Since its establishment in 2008, the Centre has focused on increasing awareness on climate change related issues by conducting literature reviews on the economic and livelihood dimensions of climate change, undertaking an assessment of the economic costs of recent floods in Fiji, as well as conducting a workshop on human rights and climate change. The program is expected to develop further as IUCN implements joint research, capacity development, and internship programmes related to climate change with its partners.

Case study 3 - Marine

The Pacific Ocean is a major source of seafood, in particular tuna, for other parts of the world. Nearly 70% of the world's annual tuna harvest comes from this region. A recent Asian Development Bank report has found the value of fisheries production from the Pacific Islands and adjacent high seas to be over US\$ 2 billion annually at the point of production. Climate change and overfishing are increasingly threatening these fisheries, and the marine and coastal ecosystems of the Pacific on which they rely.

IUCN Oceania's Marine Programme is analyzing the ecological impacts of longline tuna fishing in relation to sea mounts. IUCN is interested in the conservation aspects, exploring whether there are patterns in the amount and/or size of fish around seamounts, and identifying possible spawning or aggregation sites.

It is also working on a regional mangrove initiative which will help Pacific Islands mitigate hazards related to rising sea level and evolving weather conditions. This will include understanding the ecological link between mangroves and the adjacent coral reefs and seagrass beds. It will also assist Pacific Island countries in implementing sound evidence-based policies, plans and actions, and targeted capacity development in mangrove management that improves conservation and rehabilitation of mangrove ecosystems.

Climate change in South America

Extreme weather events in south America are becoming more common, as evidenced by intense rainfall in Venezuela, flooding in the Argentinean Pampas, drought in the Amazon and hail storms in Bolivia and the Greater Buenos Aires area. Historically, climate variability and extremes have had negative impacts on population, such as increasing mortality and morbidity in affected areas.

Increases in rainfall in Paraguay, Uruguay, the Argentinean Pampas and some parts of Bolivia and Brazil have affected land use and crop yields, and have increased flood frequency and intensity. On the other hand, declining trends in precipitation have been observed in southern Chile, south-west Argentina and southern Peru.

During the last decades, increases in temperature of approximately 1°C among pre-industrial levels in South America, and of 0.5°C in Brazil, were observed. Glacier retreat is accelerating, a critical issue in Bolivia, Peru, Colombia and Ecuador, where water availability for domestic consumption, hydropower generation, industry, and agriculture has already been compromised. Over the coming decades Andean glaciers are likely to disappear, heavily affecting water availability for all purposes in the region.

Almost 75% of the dry lands in the continent are moderately or severely degraded. The combined effect of human action and climate change has brought about a decline in natural land cover in the whole region. Rates of deforestation of tropical forests have steadily increased during the last 5 years. Biomass burning affects regional air quality, with implications for human health. Land-use and climate change acting synergistically will substantially increase fire risk.

Replacement of tropical forest by savannas is expected in eastern Amazonia, along with the replacement of semi-arid vegetation by arid vegetation in parts of north-eastern Brazil. Seven out of the 25 world biodiversity hotspots

are in Latin America, in areas that are undergoing habitat loss. High altitude ecosystems and cloud forests are of particular concern.

The IUCN response

South America is a region with a very high potential for REDD (Reducing Emissions from Deforestation and forest Degradation) related activities. It is covered by around 50% of the world's forests. Brazil alone is home to more than 30%, which makes it extremely interesting to elaborate relevant solutions and key policy recommendations. During 2008 the office carried out a regional consultation and a workshop on REDD, which allowed for the exchange of opinions, ideas and experiences among its member organizations, key persons, and stakeholders, and will be promoting further this kind of regional analysis.

In the Andean highlands, indigenous peoples and local communities have always faced extreme climate conditions. Consequently, they have developed adaptive strategies and technologies to cope with these conditions. IUCN SUR, IUCN's regional office, is analyzing how customary law and local governance are linked to supporting local livelihoods under climate change scenarios.

The Andean inter-tropical glacier retreat has reached critical thresholds, affecting water availability and hydropower generation throughout the region. Ecosystem-based Adaptation with specific consideration of the linkages between water management, development, social equity, and poverty, is an approach to address glacier retreat impact. IUCN SUR will be carrying out a pilot project using the ecosystem approach as a climate change adaptation tool in the Santa River basin in Peru. The project, designed using a bottom-up approach in the framework of the Water and Nature Initiative (WANI), will start in 2010.

SUR finalized preparing a protected area project in the upper watershed of the Madera River between Peru and Bolivia. One of the objectives is to create awareness among the population about the implications of climate change and big infrastructural projects. The project will promote experiences and proposals for mitigation and adaptation at local level. As it has a regional focus, it will look for the connectivity between protected areas along the

eastern Andean slope and the Amazonian lowlands in the south-western Amazon.

Finally, with funds of the European Commission, through the Biodiversity countdown 2010 Initiative, a set of indicators on Climate Change were designed and selected to be applied in Andean countries. These indicators would assess possible impacts of climate change on biodiversity in the tropical Andes, taking into account the 2010 Target. In addition, five study cases for the application of these indicators were developed through the study.

Case study 1 - REDD

To contribute to the complex discussion on how REDD activities should be designed and implemented, SUR promoted the electronic forum *Reduced Emissions from Deforestation and Degradation: What Steps has South America Taken?*.

A consultation was held on the the Conservation and Social Equity Portal (<http://www.portalces.org/>) on three main topics: 1) Approaches to address REDD, 2) Elements for effective and fair implementation, 3) Mechanisms and experiences aimed at reducing deforestation in South America. More than 250 people registered, including members from Latin America, USA, and Europe. The forum allowed for exchange of opinions, ideas and experiences concerning technical, policy, and socio-economic aspects of REDD. Following the consultation, a brief research about the state of the art of the REDD discussion in the region, and interviews with key stakeholders, three background papers have been prepared, which present the main aspects of the REDD technical and political discussion at the regional and international levels. **These documents can be accessed here:**

http://www.iucn.org/es/sobre/union/secretaria/oficinas/sudamerica/sur_trabajo/sur_bosques/mecanismos_redd/

The main results and conclusions were presented at a workshop hosted by SUR and the Ecuadorian Environmental Minister in Quito, in the framework of the 25th FAO Latin American Forestry Commission (COFLAC) meeting. Most participants were national forestry directors and/or their representatives; the workshop provided a platform for informing decision makers about the state of the art of REDD discussions.

Case Study 2 - IUCN Member: Sociedad Peruana de Derecho Ambiental

In 2008, the Sociedad Peruana de Derecho Ambiental (SPDA), supported by GTZ and other donors, undertook an initiative to document the daily struggle experienced by indigenous and local communities in their efforts to adapt to changing climatic patterns, and the coping strategies developed, in the coast, the highlands, and the jungle of Peru. The idea was to raise the attention of authorities by presenting the photos in an itinerant exhibition in various cities, also contributing to the definition of a broader climate change policy.

The publication *The climate is changing, so is my life* contains thirty images of the exhibition, a picture of how climate change is impacting – both positively and negatively – the lives of people living across Peru, and how these individuals are changing their own traditional lifestyles and habits to adapt to their new reality. The reference framework for this task is a wide-reaching process of communication and environmental education focused on the issue of climate change, where traditional and scientific knowledge complement each other: <http://www.gtz.de/de/dokumente/sp-el-clima-cambia.pdf>



Case Study 3 - Fundación Natura Colombia

Fundación Natura Colombia promotes CarbonoCero, a voluntary carbon emission mitigation mechanism in Colombia. CarbonoCero seeks to involve civil society, private and public actors in climate change mitigation according to the UNFCCC recommendations. It promotes climate change mitigation activities associated with forest landscape restoration, sustainable production practices which diminish the vulnerability of agricultural and pastoral systems, REDD, and pro-poor development initiatives in rural communities.

One of its main accomplishments is the involvement of private enterprises and public institutions leading the Colombian climate change agenda. So far, they supported mitigation projects in the departments of Boyacá, Santander, Cundinamarca and Antioquia. To participate in CarbonoCero, each person, company or institution calculates its carbon footprint and defines its emission reduction targets, selects the type of project to support - or asks for the development of a tailor made project - and pays the amount previously defined. All the participants receive a certificate and information about the selected project development and results in terms of emission reductions or carbon storage.

WWF Colombia and CECODES support CarbonoCero:

<http://www.natura.org.co/general/carbonocero-un-mecanismo-voluntario-para-la-mitigacion-del-cambio-climatico.html>

2. Selected climate change issues



Picture: Praying for the rain is at community meeting in Shesheke in Kalobolelwa village. Photo: Senja Väättäinen

Gender and climate change

Climate change impacts will be differently distributed among different regions, age classes, income groups, and genders. The poor, especially poor women (which sum up to 70% of the total), will be disproportionately affected. On the other hand, women are also powerful agents of change by playing a key role in energy consumption, deforestation, burning of vegetation, population and economic growth.

Women are the main producers of staple crops worldwide, providing up to 60–80% of the food in most developing countries, and up to 90% in poor, rural contexts. At the same time, they are more vulnerable to nutritional problems and to epidemics, both of which are on the rise due to climate variability, and related food and water shortages. Gender significantly affects vulnerability to natural disasters. In more inequitable societies men are likely to receive preferential treatment in rescue efforts and women are likely to suffer more from shortages of food and other resources in the aftermath of disasters. Women constituted 90% of the 140 000 people killed in the 1991 cyclone disaster in Bangladesh.

Women's empowerment is now being linked to climate change solutions. In November 2006, Kenya's Greenbelt Movement, founded by Nobel Peace Laureate Wangari Maathai, and the World Bank's Community Development Carbon Fund signed an emissions reductions agreement to reforest two mountain areas in Kenya. Local groups will plant thousands of trees, an activity that will also provide income to poor rural women. This process will also allow to capture 350 000 tons of carbon dioxide, restore soil lost to erosion, and support regular water flows essential to Kenya's farmers and hydro-electric power plants.

The IUCN response

IUCN is influencing climate change mitigation and adaptation policies to allow for the inclusion of gender and biodiversity concerns from local to global level (i.e. development of gender-biodiversity criteria and guidelines for national adaptation policies, capacity building for

decision makers, and elaboration of national adaptation platforms). It aims at mainstreaming gender equity consideration into all post-Kyoto policies (i.e. incorporating gender into financing mechanisms to ensure equitable access to resources and incentives).

IUCN is also supporting more equal participation of women in decision making for climate change mitigation and adaptation at the national, regional and international level. We provide guidance to decision makers to implement adaptation measures which take into account gender and conduct research in gender-specific resource-use patterns; gender-specific effects of climate change; gender aspects of mitigation and adaptation; women's and men's capacities to cope with climate change; and gender-related patterns of vulnerability. Finally, we provide support and capacity building for women at risk to enhance their adaptive capacity (i.e. poverty alleviation projects, sharing information through networks of women in the South).

Case Study : GGCA

IUCN's work on gender and climate change is carried out in partnership with the Global Gender and Climate Alliance (GGCA), along with the Women's Environment and Development Organization (WEDO) and over 25 UN agencies, civil society organizations, governments, foundations, and private sector



institutions.

To develop capacities at the national level, IUCN and GGCA have organized training for trainers, attended by gender experts from different regions and countries, including Africa, Latin America, the Caribbean, Asia, Arab states, and Eastern Europe. Several delegates to the UNFCCC have participated in the IUCN and GGCA Orientations on Gender and Climate Change held during the Convention sessions in

Poznan, Bonn, Bangkok and Copenhagen in 2008-2009.

A series of regional trainings have taken place in Asia, Africa, Latin America, Arab states, and Small Island Developing States (SIDS). The training sessions combine a three-day training



of trainers and a one-day orientation for government delegates, focusing on capacity-building and highlighting the importance of making the climate policy texts gender-responsive.

IUCN and GGCA partners developed a training manual on gender and climate change which deals with gender mainstreaming and international law instruments to promote it, gender sensitivity of mitigation and adaptation actions, technology development, and financing. In addition to the background and technical sections, the manual includes exercises, case studies, training techniques, and extensive references. It is available in English, French and Spanish:

<http://data.iucn.org/dbtw-wpd/exec/dbtwpub.dll>

Climate change and environmental law

The IUCN Environmental Law Programme is an integrated programme of activities that assists decision makers with information, legal analysis, advisory services, legislative drafting, mentoring and capacity building at national, regional and global levels. The Programme also provides the opportunity and the forum for governments, non-government organisations and others to network and to share information and discuss ideas

Case Study 1: TEMATEA - Synergies between Climate Change and Biodiversity

The UNEP-IUCN TEMATEA project aims at providing a logical framework for the implementation of commitments and obligations under different regional and global biodiversity-related agreements. TEMATEA is used as a checklist of national commitments and has supported the development of national plans and strategies, facilitated the preparation and implementation of multi-convention project proposals and improved understanding of how regional and global instruments interact.

Six issues which have universal relevance and are crucial towards reaching the 2010 Biodiversity Target are currently covered, each by a specific module. ELC developed the ones on Access and Benefit Sharing and on Climate Change and Biodiversity. Climate change and its associated effects are one of the major threats to the conservation and sustainable use of biodiversity. Some measures taken to address it, including under the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol (KP), have been identified as having potentially negative impacts on biodiversity. This complex relationship is the focus of the Climate Change and Biodiversity module.

To provide easy access to a large amount of information and to facilitate the distribution and use of the modules, TEMATEA has been made available on a website (www.tematea.org),

available in English, and partly in French and Russian. It includes full text of those articles and decisions, provides commentaries on complementarities and overlaps, and refers to background information on the reviewed agreements.

Based on the module on Climate Change and Biodiversity, a study was undertaken in 2007 by the Department of Environment of the Seychelles, with the objective of analyzing all national legislation, programmes, policies, and projects relating to climate change and biodiversity in the country, and compare this analysis to what is required from Seychelles through the various signed Multilateral Environmental Agreements (MEAs). The results of the study were discussed during a workshop, attended by a wide array of stakeholders from the "Environment Management Plan of Seychelles" (EMPS 2000-2010), the main multi-stakeholder, comprising government officials, NGOs, and the private sector.

Case Study 2: Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD) legal frameworks

The Environmental Law Centre has finalized an extensive publication on REDD national legal frameworks, including four case studies from Guyana, Brazil, Papua New Guinea and Cameroon. It discusses the main legal issues relating to REDD, including ownership of forest, land and carbon; participation and rights; revenue-sharing; and establishing baselines that ensure added-value and permanence.

Clear national legal frameworks will be essential for addressing all of the above issues in both immediate 'readiness' work and longer-term national strategies for REDD. A clear understanding of legal and institutional design issues will be essential for host country lawmakers developing domestic frameworks, as well as for international negotiators working to guarantee effective, efficient and equitable REDD approaches in a future UNFCCC agreement. The document can be accessed here:

<http://data.iucn.org/dbtw-wpd/edocs/EPLP-077.pdf>

Oceans, coasts and climate change

The ocean plays a crucial role in climate regulation. It absorbs most incoming solar heat, is the world's largest carbon sink, and drives the global water and precipitation cycle. Changing its composition and capacity to absorb these gases has global consequences. Rising atmospheric CO₂ levels and climatic changes are affecting marine ecosystems, the human communities that depend on them and the very ability of the ocean to absorb this greenhouse gas. Due to the significant geophysical time lags, these processes will affect the state of the world's ocean for millennia to come.

Rising sea-levels – Warming temperatures cause both ocean thermal expansion and land-ice melting processes, triggering sea-level rise. To date, the ocean has experienced an increase in temperature only in the upper hundred meters. As warming extends, additional rise can be expected. Global average sea level rose an estimated 0.17m during the 20th century, and, if the current trend continues, is likely to rise by 1m or more by 2100, with catastrophic consequences for coastal erosion rates, salinization of important aquifers and loss of living space for hundreds of millions of people.

Ocean acidification – The ocean absorbs approximately one quarter of anthropogenic CO₂ emissions every year. The uptake of carbon, nitrogen and sulphur heavily changes the ocean's chemical composition. Surface-ocean acidity has already increased by 30% above pre-industrial levels, decreasing seawater's capacity to absorb CO₂ and severely affecting calcification of important organisms, such as certain types of plankton, scleractinian corals and coralline algae. This could have knock-on effects cascading throughout food chains, affecting commercially-important fish stocks and the food supplies of millions of people.

Coral bleaching – Coral reefs are often dubbed the 'canaries in the coalmine' for climate change because of their high sensitivity to thermal stress. In 1998, an estimated 16% of the world's tropical hard corals were lost to a mass bleaching event, a phenomenon where corals expel the symbiotic micro-algae that provide them with energy and pigment. Such events are predicted to become more frequent and more intense due to rising sea temperatures. If current emissions trends continue many of the remaining coral reefs may be lost over the next 20 to 40 years, threatening lives and livelihoods of hundreds of millions of people in developing tropical countries through loss of billions of dollars worth of goods and services (including fisheries, tourism, protection from storms and coastal erosion and medicinal value).

Melting polar ice – Average Arctic temperatures have increased at almost twice the global average rate in the past 100 years. Since 1978 the annual average Arctic sea ice extent has shrunk by 2.7% per decade, with larger decreases in summer (7.4% per decade). Arctic sea ice shrank to less than half of its normal minimum area in the summer of 2007. Within the next 30 years the Arctic could be entirely ice-free during summer months, with catastrophic effects on the local biodiversity. The poleward migration of many species and the lack of displacement options for cold-water organisms will mean high rates of species invasions and extinctions in the region. An ice-free Arctic will also allow for new shipping passages, fishing, and mining activities, which could have adverse impacts on the fragile marine environment.

Changing ocean circulation and current patterns – Climate change may slow down ocean thermohaline circulation and alter the patterns of up- and downwellings essential to the productivity of marine ecosystems. Even small, localized changes may affect marine ecosystem productivity, oceanic CO₂ uptake and oxygen concentrations, and distribution of commercial fish stocks. Changing wind and current patterns can put highly productive continental shelves at risk of extreme low oxygen events, and can affect the strength of dense water exchange mechanisms, crucial to coastal water quality, nutrient cycling, and deep-water production in more than 75% of the world's fishing grounds, possibly devastating a multi-billion dollar industry that feeds billions of people.

The IUCN response

The IUCN Global Marine Programme (GMP) is engaged in a range of cutting-edge research projects and analysis on marine climate change issues, from high seas to tropical reefs, ecosystem-based adaptation and sustainable mitigation measures.

Adaptation and resilience work is a key area for the GMP. IUCN focuses on synergies between science, management, and policy to enhance coral reef resilience. It also promotes the establishment of networks of marine protected areas as key tools to enhance adaptation and resilience of marine ecosystems to the harmful effects of climate change, while also protecting biodiversity and allowing for the replenishing of fisheries.

Coastal ecosystems represent a huge and currently untapped potential for nature-based mitigation solutions. In an era where carbon trading and associated credit schemes are

becoming increasingly important in combating climate change, growing attention needs to be given to marine ecosystems and their possibilities to store carbon. IUCN GMP has provided latest scientific findings on the potential of natural coastal ecosystems, such as tidal marshlands, mangrove forests or seagrass meadows, to act as a carbon sinks. IUCN GMP also examines proposals for ocean-based CO₂ sequestration technologies (geo-engineering) as potential climate change mitigation tools, and advocates a precautionary approach in policy making. Carbon sequestration through ocean fertilisation, for instance, may dramatically alter ocean chemistry and compromise important biological cycles.

Case Study 1: Climate Change and Coral Reefs Working Group (CCCR)

The CCCR was founded in 2006 through the generous support of the MacArthur Foundation. Its objective is to use coral reefs as a model

Picture: Bleached *Acropora* coral in the Great Barrier Reef. © Paul Marshall, GBRMPA



ecosystem to prioritise climate information gaps and issues to be addressed, provide a mechanism to focus scientific contributions from leading research groups, and to synthesise the relevance of resilience science to management and policy-making concerning coral reefs and climate change. It aims to bridge gaps between theoretical science and management application in order to accelerate development and use of tools that improve the protection of coral reefs from climate change and other anthropogenic threats. It provides a forum to facilitate the exchange of information between scientists and managers, to improve recommended management practices for mitigating climate change threats to coral reefs. At government and inter-governmental levels, policy outputs from the CCCR will seek to inform efforts to reduce climate change impacts on coral reefs, and thereby empower coral reef management at local, national and regional levels.

Remarkable achievements of the CCCR to date include (a) various synthesis publications focusing on ecological and social resilience to climate change (including coral reefs, mangroves, seagrasses, dependent human societies and ocean acidification); (b) the development of a protocol for rapid onsite assessments of coral reef resilience; (c) its application in field assessments in 11 tropical countries around the world (Indonesia, Kenya, Kiribati, Madagascar, Maldives, Netherlands Antilles, Panama, Papua New Guinea, Saudi Arabia, Seychelles, Tanzania) with outputs including targeted management recommendations; and (d) the successful promotion of an IUCN resolution “Mobilizing action to build resilience and assist adaptation to climate change of coral reefs and marine ecosystems, and people that depend on them” at the 2008 World Conservation Congress in Barcelona.

www.iucn.org/cccr

Case study 2: European Project on Ocean Acidification (EPOCA)

www.epoca-project.eu

Research on ocean acidification is still quite recent, but there is already a considerable body of work underway. There has also been a rapid rise in concern at the highest political levels for the consequences of ocean acidification to our future wellbeing. The challenge is to link these

two strands together, so that the policy and decision making system is quickly informed on the latest developments from the scientific world.

IUCN participates in the Reference User Group of EPOCA, collaboration between major European research institutes to produce knowledge on, and assess vulnerability of, marine ecosystems threatened by ocean acidification. It is the largest project of its kind in the world. Its main activities are to document the changes in ocean chemistry and geographical distribution of marine organisms across space and time; to quantify the impact of ocean acidification on marine organisms and ecosystems; to integrate the impacts of ocean acidification into biogeochemical, sediment and coupled ocean-climate models; and to assess uncertainties, risks and thresholds ('tipping points') related to ocean acidification. IUCN GMP is playing a major role in EPOCA by filling the critical communication gap by developing an outreach strategy for ocean acidification research carried out in the Northern Hemisphere.

Case study 3: Greening blue energy

Offshore renewable energy development (e.g. wave and wind power) is expanding significantly throughout marine and estuarine environments, in both temperate and tropical regions. The impacts of large-scale development ventures on the marine environment are a cause of concern. Discussions centre on disturbance effects from noise, shadows, electro-magnetic fields, and changed hydrodynamic conditions and habitat structures, on benthic communities, fish, mammals, and birds, including cascading effects at ecosystem levels. Indirect effects of fisheries exclusion, and environmental hazards due to redirection of shipping, are also of concern. At the same time, opportunities for combining Offshore Energy Development (ORED) with fisheries management and conservation interests receive increasing attention.

Large knowledge gaps exist on the impacts of offshore wind and wave energy farms, and the existing knowledge is largely not compiled or accessible in updated and user friendly formats for coastal managers, entrepreneurs, policy makers, and local stakeholders. This hampers environmental impact assessments and the

issuing of permits. If no pre-cautionary approach is applied, this could also put areas and species of conservation interest at risk. The GMP has produced user-friendly, process-oriented overviews of environmental risks and potentials, along with guiding principles and policy regulation options, stakeholder analyses, and annotated bibliographies of large-scale ORED. Areas of conservation interest are pointed out to support strategic environmental assessments.

The outputs will enable well-balanced science-based discussions and considerations on impacts on the marine environment of offshore renewable energy installations at the political level as well as among the conservation community, private business and local stakeholder levels. This will facilitate the further instalment of offshore wind and wave energy using due precautionary approaches and assist in good quality assessments, especially when dealing with sensitive areas, as well as advance the development of mitigating construction methods and other measures for the benefit of the marine environment. The project also includes important knowledge exchange between North and South, and the provision of capacity enhancing tools for effective and sustainable ORED in developing countries.

Social policy

and
climate change

Climate change has enormous social implications, in particular for poverty, equity and human rights. The poor and marginalized, such as indigenous and traditional peoples and women, are generally hit hardest by climate change impacts as they already are disproportionately vulnerable. Changing rainfall patterns, droughts, floods, salinization of aquifers, more frequent and intense winds and fires will specifically impact on livelihoods, food security and health of poor, natural resource-dependent communities, particularly in the developing world. The disproportionate impacts those people are suffering are further contributing to rising inequalities and making it much harder to progress in the achievement of

the Millennium Development Goals.

Indigenous and poor rural peoples have the smallest ecological footprint and are least responsible for global greenhouse gas emissions. Nonetheless, they are amongst the worst affected, since they often are directly dependent on fragile ecosystems, which are being heavily impacted by climate change. They have been historically excluded from decision-making processes, face insecurity of tenure on their lands, territories, and resources, and are often not adequately considered by political institutions and legal systems. Some mitigation measures such as REDD (Reducing Emissions from Deforestation and forest Degradation) and biofuels present serious threats to some of their rights. On the other hand, traditional knowledge represents an important source of adaptation and mitigation strategies, which could significantly contribute to combating climate change.

Indigenous peoples and rural communities, as well as future generations, pose some of the most urgent social justice questions. As a consequence, several international initiatives which discuss human-rights based approaches to climate change are now emerging.

Photo: Fishermen in Mwansabombwe in Luapula Province in Zambia. (Photo: Senja Väättäinen)



The IUCN response

The climate change related work of IUCN's Social Policy Unit focuses on understanding the links between social and ecosystem vulnerability, as a base for developing conceptual and policy guidance to address climate change mitigation and adaptation from a human right and equity perspective, and for helping communities building up their resilience and understanding the role of traditional knowledge.

Specific work includes providing indigenous peoples networks, as well as institutions like the UN and the European Union, with policy advice on traditional people and climate change. The Unit also issued a report on "*Indigenous and Traditional Peoples and Climate Change: Vulnerability and Adaptation*".

Case Study 1: Climate Change and Development Project

The IUCN Climate Change and Development Project is working with IUCN members and partners in Mozambique, Tanzania, and Zambia to support community-based climate change adaptation, and to link practice and policy to improve national and regional adaptation frameworks. The project is supported by the Ministry of Foreign Affairs of Finland and is being carried out by the East and Southern Africa Regional Office and the Forestry Conservation Programme.

Climate variability and extreme weather events are already affecting many communities in the region, posing significant challenges to poverty reduction and other development and conservation objectives. There is an urgent need to enhance community resilience and reduce vulnerability, and equitable and effective ecosystem management can play a key role in meeting this need.

This project aims to strengthen the enabling environment for adaptation, build awareness and capacity to reduce risk and enhance resiliency, and implement community-based adaptation measures in over ten pilot sites. Activities include:

- Analyzing both broad adaptation frameworks and field-level experiences to develop concrete recommendations for enhancing local, national and

regional adaptation policies and institutions, including through ecosystem management;

- Training project partners in climate change vulnerability assessments and adaptation strategy identification using multi-stakeholder processes and a range of tools (including CRISTAL – Community Risk Screening Tool: Adaptation and Livelihoods www.cristaltool.org);
- Supporting community-based implementation of ecosystem management related adaptation measures by working with local government, NGO, and CBO partners active in pilot sites; and
- Facilitating discussion and promoting the exchange of information, knowledge and lessons learned between local communities, NGOs and decision makers at the local, national and regional levels.

Species

and climate change

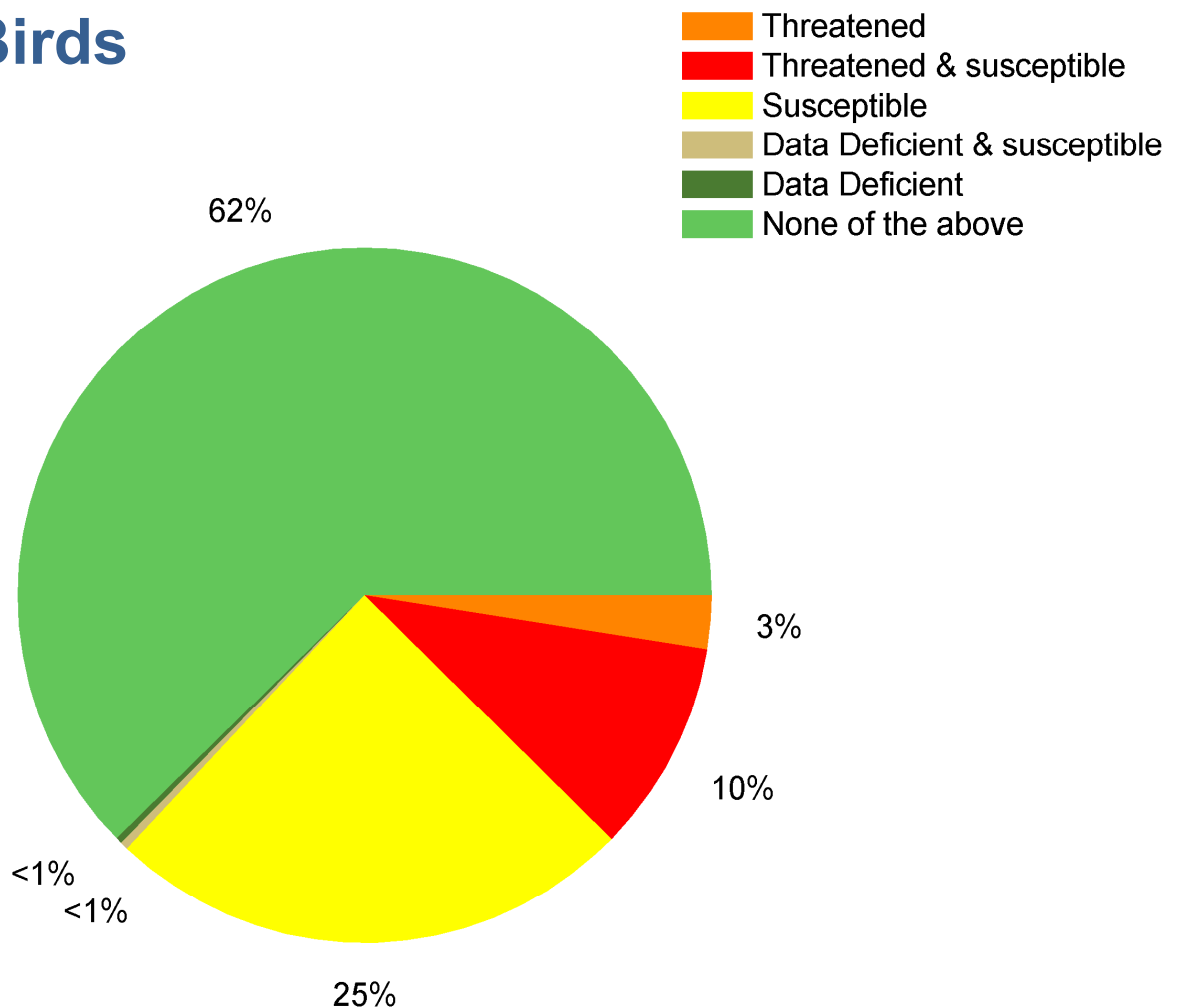
Approximately 20 to 30% of plant and animal species are likely to be at increasingly high risk of extinction as global mean temperatures exceed warming of 2 to 3°C above preindustrial levels, according to Intergovernmental Panel on Climate Change (Fourth Assessment Report). Global warming has already been implicated in hundreds of documented cases of species declines across marine, terrestrial and freshwater ecosystems globally, including in the loss of amphibian species such as the Golden Toad. Climate change will be one of the major drivers of species extinctions in the 21st century.

The IUCN response

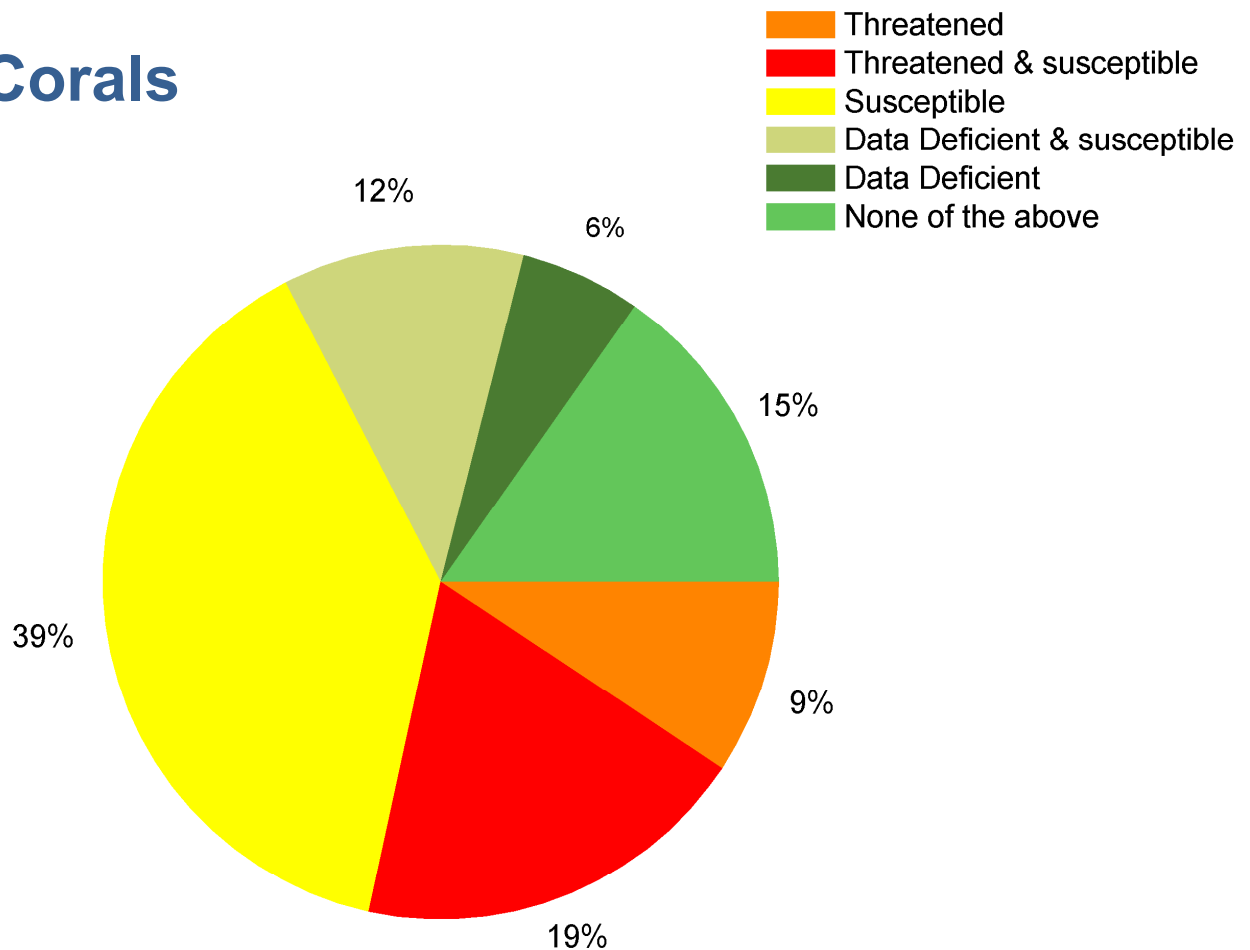
General Circulation Models (GCMs) predict that climate change will affect different areas of the world to different degrees. But it is also widely recognized that not all species will respond in the same way, even to similar levels of climatic change. Some species are much more susceptible to climate change impacts than others due to their life history, and their ecological, behavioural, physiological and genetic traits. Species that are in greatest danger of climate-change driven extinction are those with high susceptibility to climatic changes, that also have distribution ranges that will experience large climatic changes and where their adaptive capacity is low.

IUCN Species Programme is working to identify those traits that are most relevant for climate change susceptibility, in order to identify the species that are facing the greatest risk of climate change induced extinction. The hope is to contribute a practical new conservation tool to help prevent extinctions.

Birds



Corals



Case Study 1: Mac Arthur project

With funding from the MacArthur Foundation and the Indianapolis Zoo, IUCN has initiated a project to identify the species most vulnerable



SPECIES SURVIVAL COMMISSION

negative impacts of climate change. Based on information from the IUCN Red List (www.iucnredlist.org), IUCN and its partners have identified biological traits that make species most susceptible to climate change, falling into 5 groups: (Specialized habitat and/or microhabitat requirements, narrow environmental tolerances or thresholds that are likely to be exceeded due to climate change at any stage in the life cycle, dependence on a specific environmental trigger or cue that is likely to be disrupted by climate change, dependence on interspecific interactions that are likely to be disrupted by climate change, poor ability to disperse to or colonize a new or more suitable range).

The world's birds (9856 species), amphibians (6222 species) and reef-building corals (799 species) have been analyzed in the light of this classification. Preliminary analyses suggest that up to 35% of birds, 52% of amphibians and 71% of reef-building corals have traits that are likely to make them particularly susceptible to

climate change. 70-80% of birds, amphibians and corals that were already classified as threatened in the Red List are also “climate-change-susceptible”. Of those that are not considered threatened, 25-51% are “climate-change-susceptible”.

Assessments of ‘climate-change-susceptibility’ will complement IUCN Red List assessments of extinction risk and serve as a ‘warning flag’, highlighting the need for intensive monitoring and potentially conservation action for affected species.

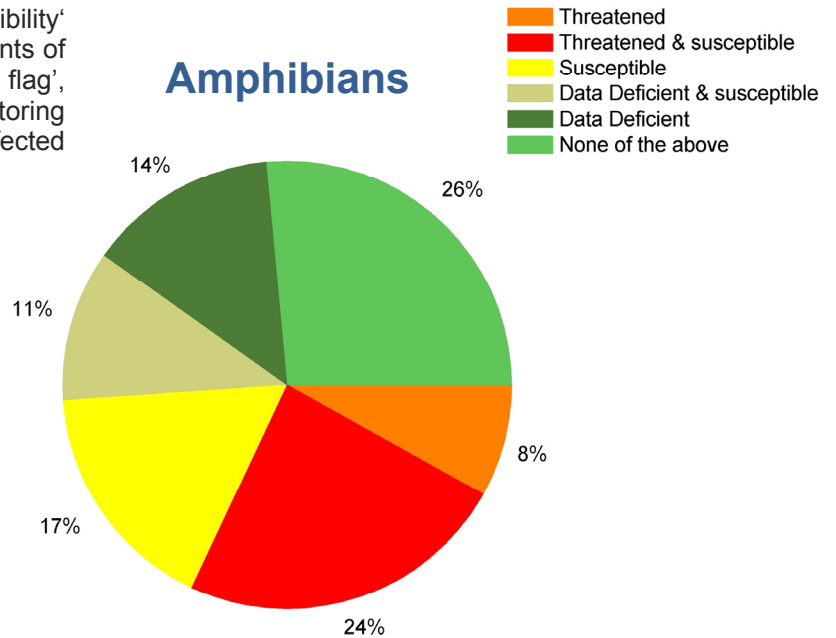


Photo: *Cochranella antisthenesi* lives only in a restricted area of Venezuelan forest. It is currently considered to be Vulnerable and has also been assessed as “climate-change-susceptible”. While already considered Vulnerable, Venezuelan forest dwelling *Cochranella antisthenesi* has been assessed as “climate-change-susceptible”. Credit: Ariadne Angulo





Photo: Women at a pump in Tanzania, IUCN/Taco Anema

Water and Climate Change

Climate change impacts will be felt first and foremost through water. Droughts, severe storms, and floods will become more frequent and intense. Mountain glaciers, in the Andes and Himalayas most critically, will melt, increasing the risk of landslides and flooding, and reducing freshwater availability in the long term. Sea-level rise will bring a higher risk of coastal inundation and erosion. The numbers of people living with limited access to scarce water supplies is expected to climb from the current 1.7 billion up to 3.2 billion by 2080 (IPCC, 2008). Water is crucial both for adaptation policies, planning and action, and will be fundamental in addressing global economic, security, and social priorities.

The multi-faceted importance of water in mediating the myriad impacts of climate change has the effect of creating 'hot spots' of vulnerability. These should be the highest priority locations for adaptation, and include:

- low-lying deltas and coastal megacities: where higher frequency of flooding and coastal inundation will have the most acute impacts
- drylands: where susceptibility to more severe or more frequent water scarcity is high because of threats to food security, health and economic development
- small islands: where sensitivity to coastal erosion, inundation and salt-water intrusion is high at community and national levels
- mountains and their rivers: where retreat of glaciers and reduction in the size of winter snow packs will increase disaster risk and shift the volume and timing of downstream water availability for irrigation, industry and cities.

The IUCN response

The IUCN Water Programme aims to help governments, communities and river basin authorities adapt to the impacts of climate change. River basins and coasts are natural infrastructure for coping with these impacts. They provide water storage, flood control and coastal defense – vital services for reducing the vulnerabilities of communities and economies to

climate change. The IUCN Water and Nature Initiative (WANI) promotes the maintenance of ecosystems as infrastructures that reduce vulnerability to floods, droughts and storms, under water governance that empowers water users in decision making. Investments in the environment as 'critical national natural infrastructure' should be integral to climate change adaptation portfolios.



Water & Nature Initiative

Case Study 1: The Pangani River Basin

In the Pangani River Basin (Tanzania), over-allocation is worsening water scarcity. The 3.4 million people living in the area are vulnerable to projected drying of the climate. Efforts are underway to implement '**environmental flows**', an ecosystem-based method for allocating water to different uses within sustainable limits, based on negotiations among different stakeholders (Dyson et al., 2003). Implementation entails developing and coordinating decision-making over water allocation from local to basin scales. Institutional strengthening is key in enabling the stakeholders' participation and joint action. Ideally, authorities should enlist representatives of competing water users – farmers, hydropower, fishers, residents, and ecosystems alike – to help decide how to allocate water.

Combining a local sense of who needs what, when, and where, with scientific data on how much water is available now and might be available under climate change scenarios, the collaborators are piloting a new, and flexible, approach to informed decision-making. They are learning to allocate water within the limits of the river's flow, also considering the needs of ecosystems in the basin that store water, regulate flows, and support livelihoods. Allocation of water to sustain natural infrastructure, such as wetlands and estuary habitats, and adaptive governance, provide capacity to deal with uncertain future events. Through the support of WANI and others, better water governance and best practices will reduce pressure on ecosystems and start to

make communities and the economy in the Pangani basin less vulnerable to climate change. (West Africa, IUCN/Taco Anema)

Case Study 2: Mexico – Guatemala

In the high-altitude upper watersheds of the Coatán and Suchiate rivers (Guatemala, Mexico), which flow off the slopes of the Tacaná volcano to the Pacific Ocean, ecosystem degradation and climate change are raising the risk of devastating flash floods. Deforestation, with associated severe erosion of formerly deep soils, has reduced capacity for water retention, which has contributed to the narrowing of livelihood options for the population in the area. Communities in the upper and lower watersheds are vulnerable to flooding caused by intense rainfall. Flooding risk is exacerbated by the lost water storage capacity of the eroded soils which leads to increases in the volume and rate of runoff. Disaster preparedness is now a high priority for authorities when managing climatic variability and climate change adaptation. With support from WANI, local communities have built micro-watershed councils to lead watershed restoration and development that meet their priorities. Empowerment of community-owned



Photo: Flood in Mexico, IUCN/Taco Anema

institutions is making watersheds more secure and livelihoods less vulnerable.

Case Study 3: Komadugu Yobe River, Nigeria

Decades ago, dams and diversions were built on the Komadugu Yobe River that flows through Nigeria's arid northeast before draining into the shrinking Lake Chad. Flow in the river has fallen by 35% and eroded the livelihoods of millions because of the combined effects of abstraction of water for large-scale irrigation and regional drying of the climate. Stresses like these in an impoverished and ethnically splintered region have led to resource scarcity and social tensions. Thanks to a joint basin-level intervention by IUCN and partner organizations, the federal and state

governments and other stakeholders, including dam operators and farming, fishing, and herding communities, came together to negotiate a plan for coordinating and investing in restoration and management of the basin. In addition to agreeing to a Catchment Management Plan, a 'Water Charter' was drafted that spells out the principles for sustainable development of the basin and the roles and responsibilities of governments and stakeholders. Reform of water governance is enabling transparent coordination of water resource development, including remediation of degraded ecosystems and, eventually, restoration of the river's flow regime. Dialogue and investment in natural infrastructure have provided people with more than the assets needed to make their livelihoods more resilient to future uncertainty related to climate change (KYB Project, 2008, Smith & Barchiesi, 2009).



Photo: Komadugu Yobe River, Nigeria

Climate change and IUCN commissions

IUCN unites 10 000 volunteer experts within six commissions in order to assess the state of the world's natural resources. Climate change is one of the areas to which commission experts give key inputs. IUCN benefits from commission climate change expertise and collaboration on publications, projects, events, and programmes, as described below.



Commission on Education and Communication

CEC Chair: Keith Wheeler

Focus: CEC champions the strategic use of communication and education to empower and educate stakeholders for the sustainable use of natural resources. Members: 600.

Recent work on Climate Change: The CEC hosted high level climate change meetings at IUCN's 4th World Conservation Congress in Barcelona, Spain, in October 2008. It has built a network of partners from the world of international security and climate change. Meetings with organizations such as NATO, Woodrow Wilson Institute, Centre for Naval

Analysis and other have led to a conference in Brussels and a workshop of top military leaders (October 2009) to send a strong signal to Copenhagen from the perspective of international security. CEC is also collaborating with the IUCN Secretariat on an internal climate change policy training programme.



Commission on Environmental, Economic, and Social Policy

CEESP Chair: Aroha Te Pareake Mead

Focus: CEESP provides expertise and policy advice on economic and social factors for the conservation and sustainable use of biological diversity. Members: 1000.

Recent work on climate change: CEESP unites field experts gathering climate-related knowledge around the globe. This knowledge is collected, processed, and made available to policy makers. For instance, CEESP elevates issues such as communities forced to relocate due to the impacts of climate change. CEESP also started a YouTube dialogue on the climate change impacts on communities. The recent October 2008 edition of *Policy Matters* provides many of these case studies. CEESP also unites a working group on Reducing Emissions from Degradation and avoided Deforestation (REDD), which has published a briefing note titled "*The hottest REDD issues: rights, equity, development, deforestation and governance by indigenous peoples and local communities*".



Commission on Environmental Law

CEL Chair: Ms. Sheila Abed de Zaval

Focus: CEL advances environmental law by developing new legal concepts and instruments, and by building the capacity of societies to employ environmental law for conservation and sustainable development. Members: 800.

Recent work on climate change: CEL's Specialist Group on Energy Law and Climate Change is engaged in research activities on various levels and in policy work on climate change.



Commission on Ecosystem Management

CEM Chair: Piet Wit

Focus: CEM provides expert guidance on integrated ecosystem approaches to the management of natural and modified ecosystems. Members: 400.

Recent work on climate change: CEM's work touches on many climate change areas. CEM is particularly looking at restoration, connectivity, and ecosystems services. CEM is planning a series of workshops on Payments for Ecosystem Services and is also working on a Red List of Ecosystems which will address climate change as a threat. CEM is also

planning workshops on ecosystem-based adaptation.



Species Survival Commission

SSC Chair: Simon Stuart

Focus: SSC advises the Union on the technical aspects of species conservation and mobilizes action for those species that are threatened with extinction. Members: 7500.

Recent work on climate change: Contributing to the IUCN Red list is a vital part of the SSC's climate change work. The SSC will continue to contribute to revising the Red List criteria as more taxonomic groups are threatened by climate change impacts. In addition species migration will be another focal area.



World Commission on Protected Areas

WCPA Chair: Nik Lopoukhine

Focus: WCPA promotes the establishment and effective management of a worldwide representative network of terrestrial and marine protected areas. Members: 1300.

Recent work on climate change: WCPA is focusing on connectivity between protected areas (PAs) and the adaptation of species to climate change through migration. The WCPA Mountain Protected Areas Network, for example, offers guidance on climate change impacts to the mountain biome. WCPA is also looking at the role of PAs as carbon sinks for mitigation.

In addition, the WCPA Task Force on Cities and Protected Areas is active on climate change issues. This task force promotes the use of urban PAs for public education and

engagement on climate change issues and will incorporate this work into its forthcoming Best Practice Guidelines Series section on urban PAs.

WCPA is also leading the PACT 2020 initiative, working to assess the role of resilient protected area systems in a changing climate, including the role they can play in maintaining ecosystem services and enhance adaptation. A workshop was held in Andalucia, in November 2009 and a key document, "*Natural Solutions: protected areas helping people cope with climate change*" was launched in December 2009: <http://data.iucn.org/dbtw-wpd/edocs/2009-045.pdf>



INTERNATIONAL UNION
FOR CONSERVATION OF NATURE
WORLD HEADQUARTERS
Rue Mauverney 28
1196 Gland, Switzerland

mail@iucn.org

Tel +41 22 999 0000
Fax +41 22 999 0002
www.iucn.org

